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Maternal Depressive Symptoms and Adherence to Therapy in Inner-City Children With Asthma

Susan J. Bartlett, PhD*; Jerry A. Krishnan, MD*; Kristin A. Riekert, PhD*; Arlene M. Butz, ScD‡; Floyd J. Malveaux, MD§; and Cynthia S. Rand, PhD*

ABSTRACT. *Context.* Little is known about how depressive symptoms in mothers affects illness management in inner-city children with asthma.

Objective. Our goal was to determine how maternal depressive symptoms influence child medication adherence, impact of the child's asthma on the mother, and maternal attitudes and beliefs.

Methods. Baseline and 6-month surveys were administered to 177 mothers of young minority children with asthma in inner-city Baltimore, MD and Washington, DC. Medication adherence, disruptiveness of asthma, and select attitudes toward illness and asthma therapy were measured. Six-month data ($N = 158$) were used to prospectively evaluate long-term symptom control and emergency department use. Independent variables included asthma morbidity, age, depressive symptoms, and other psychosocial data.

Results. No difference in child asthma morbidity was observed between mothers high and low in depressive symptoms. However, mothers with high depressive symptoms reported significantly more problems with their child using inhalers properly (odds ratio [OR]: 5.0; 95% confidence interval [CI]: 1.3–18.9) and forgetting doses (OR: 4.2; 95% CI: 1.4–12.4). Depressive symptoms were also associated with greater emotional distress and interference with daily activities caused by the child's asthma, along with less confidence in asthma medications, ability to control asthma symptoms, and self-efficacy to cope with acute asthma episodes. In addition, depressed mothers reported less understanding about their child's medications and use (OR: 7.7; 95% CI: 1.7–35.9). Baseline asthma morbidity, maternal depression scores, and family income were independently associated with asthma symptoms 6 months later, whereas medica-

tion adherence was not predictive of subsequent asthma morbidity or emergency department use.

Conclusions. Maternal depressive symptoms were not associated with child asthma morbidity but were associated with a constellation of beliefs and attitudes that may significantly influence adherence to asthma medications and illness management. Identifying and addressing poor psychological adjustment in mothers is important when developing a child's asthma treatment and may facilitate parent-provider communication, medication adherence, and asthma management among inner-city children. *Pediatrics* 2004;113:229–237; *asthma, maternal depression, medication adherence, attitudes, beliefs.*

ABBREVIATIONS. ED, emergency department; ICS, inhaled corticosteroid; CES-D, Center for Epidemiologic Studies-Depression scale; OR, odds ratio; df, degrees of freedom.

Depression is a common disorder that often complicates the treatment of illnesses. In persons with chronic illnesses ranging from heart disease to rheumatic illnesses, growing evidence indicates that depression is linked with higher rates of health care utilization,^{1,2} significant impairment in daily functioning,³ diminished quality of life,⁴ and poorer treatment outcomes.^{5,6} Living with a chronic illnesses is an independent risk factor for depressive symptoms.^{7,8} Depressive symptoms in turn may influence illness outcomes through physiologic pathways such as changes in neurotransmitter regulation and illness-related behaviors.^{5,9–11}

One example of this link is the recent finding that depressive symptoms are associated with nonadherence to treatment recommendations. In persons with a wide range of medical conditions including human immunodeficiency virus/acquired immunodeficiency syndrome,^{12–14} osteoporosis,¹³ diabetes,¹⁵ and cardiac transplantation,¹⁶ high levels of depressive symptoms are associated with decreased adher-

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ence to therapy. In recent meta-analyses of studies from 1968 to 1998, DiMatteo et al¹⁷ concluded that depressed persons were 3 times as likely to be non-adherent with medical treatment recommendations than persons who were not depressed.

Adolescent and adult women are particularly vulnerable to depressive symptoms, with 10%–25% of women experiencing a major depressive episode at some time in their lives.¹⁸ Poverty, low socioeconomic status, unemployment, and having young children place inner-city women at greater risk. Having a child with a chronic illness further exacerbates risk for depression among inner-city mothers, with reported point prevalence rates nearing 50%.^{19–22}

To our knowledge, no studies have addressed the impact of maternal depressive symptoms on the illness management of chronically ill inner-city children. Recently, we reported that maternal depression was a potent risk factor for emergency department (ED) use among young inner-city children with asthma.¹⁹ The goal of the present study was to expand these findings by evaluating how maternal depression influences asthma management in inner-city children. Specifically, we wanted to explore how depression influenced the impact of the disease on the mother, maternal attitudes toward the child's illness and therapy, as well as the child's adherence to prescribed asthma medications. Six-month follow-up data were used to prospectively evaluate long-term symptom control and health care utilization. We hypothesized that mothers with high levels of depressive symptoms would report greater disruption in their lives, more negative attitudes toward asthma therapy and care, and poorer adherence with controller asthma therapy (ie, inhaled corticosteroid [ICS] therapy) in their children than mothers with low levels of depressive symptoms. We also hypothesized that poorer adherence would be related to increased asthma symptoms and ED use in the following 6 months.

METHODS

Study Sample

This cohort study combines data from 2 identical surveys administered at baseline and 6 months later in community-based interventions designed to evaluate and improve asthma management among minority inner-city children and their families. Study methods have been described.¹⁹ Sixty-five inner-city elementary schools from Baltimore, MD and Washington, DC were contacted and invited to participate. Schools were selected if they met the following criteria: 1) >85% of the students were African American; 2) >350 students were enrolled in the school; and 3) administrative consent to participate in a subsequent asthma-education study was obtained. The initial surveys were conducted between October 1996 and September 1997 and were approved by the Joint Committee on Clinical Investigation of the Johns Hopkins University School of Medicine.

Participants

Mothers who had elementary school-aged children (ie, kindergarten through 5th grade) with an asthma diagnosis on their school health records were screened for eligibility. Mothers were eligible if they reported that their child had 1) asthma diagnosed by a physician, 2) day or night asthma symptoms including wheeze, shortness of breath, and/or cough at least once a week during the past 2 weeks, and/or 3) at least 1 visit for asthma to the ED in the previous 6 months or 1 overnight hospitalization for

asthma in the previous year. Ninety-eight percent of the families were African American.

Procedures

Parents or guardians of eligible children were mailed a consent form. After obtaining informed written consent, trained interviewers (who were blinded to the study hypotheses) interviewed by phone the person identified as the primary caregiver. The child's biological mother was the interview respondent 89% of the time. Telephone surveys of pediatric populations have generally found good agreement for medically related information when querying information such as hospitalizations and number of visits for asthma.^{23,24}

Within the total sample of 338 respondents, mood was assessed in the last 177 mothers enrolled in the studies; 6-month self-report data on ED use were available for 158 of the children in the baseline sample (89%). Mothers who did not participate in the mood assessment (ie, the first 161 caregivers surveyed) were more likely to report lower levels of asthma morbidity in their children (6.3 ± 7.2 vs 15.7 ± 11.7 ; $P < .001$ days/nights with symptoms per month, respectively) but did not differ in age, level of asthma symptoms, child age, or annual income as compared with the last 177 mothers surveyed (ie, those on whom depressive symptoms data were collected). All subsequent analyses reported were performed on this subset of 158 caregivers.

Measures

Maternal Characteristics

Maternal measures included demographic information and an assessment of depressive symptoms. Depressive symptoms were evaluated by using a modified version of the Center for Epidemiologic Studies-Depression scale (CES-D).²⁵ The CES-D has been widely used in clinical trials in both general and psychiatric populations and has sound psychometric properties (ie, reliability and discriminant and convergent validity).²⁶ The recommended clinical cutpoint score of 16 is commonly used to indicate "caseness" for depression²⁷ and has been shown to have high sensitivity (.95) and specificity (.70) in predicting major depressive disorder in low-income minority women (as compared with diagnostic interviews).¹⁸ To reduce the burden on participants and because briefer versions of the test have also been shown to have good predictive accuracy,^{28–31} an 11-item version of the CES-D was used.¹⁹ Scores on each item ranged from 0 to 3 with higher scores reflecting increased dysphoria; scores ≥ 9 were judged to reflect clinically significant levels of depressive symptoms (ie, depression), whereas scores < 9 were judged to reflect nonsignificant levels of distress.

We assessed the impact of the child's asthma on the mother using an abbreviated form of the Pediatric Asthma Caregiver's Quality of Life Questionnaire.³² This scale assesses the disruptions in normal daily activities as well as anxiety and fear caused by the child's asthma experienced by the caregivers of children with asthma. It has been shown to be reliable and valid both as an evaluative and discriminative measurement tool.³² We also asked about the mother's beliefs about selected asthma-management practices, health care providers, and her child's asthma treatment by using 4-point Likert scales.

Child Characteristics

Demographic information as well as information on the child's asthma symptoms and asthma medication use were obtained from the mother. We assessed the child's adherence to medication prescribed by his or her health care provider. Caregivers were told, "Most children have problems taking their medication just as prescribed" and then asked: 1) "How often does your child have problems using his/her inhaler the right way?" 2) "How often does your child forget to take his/her asthma medication?" and 3) "In the past 2 weeks (14 days), how many days would you guess that your child has forgotten to take his or her medicine?"

An index of the child's asthma morbidity was developed at baseline by summing the total number of days and nights during the previous 6 months that the child experienced asthma-related symptoms. Respondents were asked: 1) "For the last 6 months, on average, how many days per week did cough, wheeze, or shortness of breath limit your child's exercise, ability to play sports, or

ability to play with friends?" and 2) "For the last 6 months, on the average, how many nights per week did your child wake up at night with cough, wheeze, shortness of breath, or tightness in chest?"

Statistical Analysis

Depressive symptoms were used both as a continuous variable and to classify caregivers dichotomously (ie, high versus low). *t* test and χ^2 analyses were used to assess differences in demographic characteristics, health care utilization patterns, and asthma-management practices between mothers classified as high or low in depressive symptoms. Spearman *r* coefficients were calculated to assess the association between maternal depression and variables of interest. Responses were coded as positive (for all or most of the time) or negative (for some or none of the time), and odds ratios (ORs) were calculated to facilitate interpretation of results. Nonparametric measures of association and partial correlation coefficients were used to evaluate the relationship between baseline medication adherence with symptom control and ED use 6 months later. Linear regression was used to evaluate the independent relationship between variables of interest and 6-month asthma outcomes. Variables were selected for inclusion in the model on the basis of significant bivariate associations and theoretical importance.

RESULTS

Maternal and Child Characteristics

Maternal and child characteristics have been reported.¹⁹ Briefly, mothers were the primary caregivers (ie, 89%) with an age (mean \pm standard deviation) of 33.3 ± 6.7 years. Most (70%) had completed high school or obtained a GED degree and reported having some form of health care coverage (eg, state-sponsored medical assistance [56%] or private health care insurance [36%]). Almost half (47%) reported clinically significant levels of depressive symptoms.

The children with asthma had a mean age of 7.9 ± 2.2 years, and 59% of the sample were female. Asthma morbidity was high in this sample, with most children (64%) experiencing asthma symptoms ≥ 4 days a week. The majority of mothers (92.0%) reported that their child had used asthma medications in the past 6 months, and more than half

(56.5%) had been prescribed a daily antiinflammatory medication.

Mothers with high levels of depressive symptoms (ie, depressed mothers) were more likely to be unemployed and in the lower income categories (as shown in Table 1). Depressed mothers were also more likely to report smoking cigarettes, although this trend did not reach statistical significance. No differences were observed in age, education, or number of children at home between mothers high and low in depressive symptoms. There were no differences in age, gender, or selected markers of asthma morbidity between the children of mothers high and low in depressive symptoms (as shown in Table 2).

Impact of Child's Asthma

Modest correlations ($r = .191$ to $.343$; $P < .05$) were observed between depressive symptoms and several variables assessing the impact of the child's asthma on the caregiver (as shown in Table 3). Mothers who reported high levels of depressive symptoms were much more likely to report that the child's asthma had interfered with their normal daily activities all or most of the time in the previous week (see Table 3). Depressed mothers were >3 times as likely to report feeling upset and nearly twice as likely to report feeling helpless or frightened by the child's asthma in the previous week. Mothers who reported high levels of depressive symptoms were 3 times as likely to report having been awakened during the night by their child's asthma symptoms. However, there were no significant differences between mothers high and low in depressive symptoms regarding the need to change work or leisure plans.

Medication Adherence

Although maternal reports of adherence to controller therapy were generally high, differences were evident between depressed and nondepressed moth-

TABLE 1. Characteristics of Inner-City Mothers of Children With Asthma Low and High in Depressive Symptoms

	N	Depressive Symptoms		P Value
		High (n = 75)	Low (n = 83)	
Respondent				
Age, y				.448
22–30	52	33.3%	32.9%	
31–36	53	29.3%	37.8%	
37+	52	37.3%	29.3%	
Relationship				.881
Mother	140	89.3%	88.0%	
Father	3	1.3%	2.4%	
Other	15	9.3%	9.6%	
Education				.530
Some high school	30	28.0%	31.3%	
High school graduate/GED	81	49.3%	53.0%	
Some college/college graduate	47	22.7%	15.7%	
Employment status				<.001
Full- or part-time	104	52.0%	78.3%	
Not employed	54	48.0%	21.7%	
Annual family income				.004
<\$10 000	59	25.7%	43.2%	
\$10 000–\$20 000	42	23.0%	30.9%	
>\$20 000	54	51.4%	25.9%	
Siblings at home (mean \pm SD)	158	1.4 \pm 1.1	1.4 \pm 1.3	.955
Smokes cigarettes	46	36%	23%	.07

TABLE 2. Characteristics of Children With Asthma by Maternal Depressive Symptoms

	N	Depressive Symptoms		P Value
		High (n = 75)	Low (n = 83)	
Age, y				
4–6	55	26.7%	28.9%	.937
7–9	59	37.3%	37.3%	
10+	44	36.0%	33.7%	
Gender				
Male	66	42.7%	41.0%	.828
Female	92	57.3%	59.0%	
Mean days and nights per month with symptoms*	158	16.1 ± 12.3	15.3 ± 11.1	.692
Frequency of asthma symptoms				
0–1 times per week	26	17.3%	15.7%	.936
2–3 times per week	31	18.7%	20.5%	
4+ times per week	101	64.0%	63.9%	
Use of inhaled corticosteroid medications	142	56.9%	55.8%	.897

* All or most of the time in the past week.

TABLE 3. Caregiver Reports of the Psychosocial Impact of Child's Asthma on Their Normal Daily Routine

	N	ρ	Depressive Symptoms		OR (95% CI)	P Value
			High	Low		
Felt helpless or frightened*	151	.191†	31 (43.1%)	23 (29.1%)	1.8 (0.9–3.6)	.007
Changed plans because of child's asthma*	152	–.040	8 (15.1%)	25 (10.1%)	1.6 (0.6–4.2)	.357
Child's asthma interfered with work*	154	–.234‡	17 (23.3%)	11 (13.6%)	1.9 (0.8–4.5)	.119
Felt upset*	153	–.343‡	23 (38.4%)	13 (16.3%)	3.2 (1.5–6.8)	.002
Awakened in night because of child's cough or wheezing*	154	–.227‡	28 (38.4%)	13 (16.0%)	3.3 (1.5–6.9)	.002

CI indicates confidence interval.

* All or most of the time in the past week.

† $P < .05$.

‡ $P < .1$.

ers in the child's asthma management (see Table 4). Mothers with high levels of depressive symptoms were 5 times more likely to report that their child usually had problems using their asthma inhalers properly. They were >4 times as likely to report that their child forgot their medications "all or most of the time" in the past 6 months. Similarly, mothers with high levels of depressive symptoms were also more likely to report that their child had missed their asthma medication on ≥ 2 days in the past 2 weeks. The overall association between CES-D scores and adherence measures was relatively weak ($r = .153$ to $.172$; $P < .05$).

Beliefs About Asthma-Management Practices

A modest but consistent relationship ($r = .158$ to $.251$; $P < .05$) was observed between depressive

symptoms and caregiver beliefs about selected asthma-management practices (see Table 5). Mothers with high levels of depressive symptoms reported significantly more negative beliefs about asthma therapy. As compared with mothers with low levels of depressive symptoms, mothers with high levels were nearly 8 times more likely to state that they did not understand the function of their child's medications or how to use them. Mothers with high levels of depressive symptoms were more likely to report feeling unable to address acute asthma episodes at home. However, not all variables differed by depressive-symptom status. More than a third of all mothers reported worrying about medication side effects; 1 in 5 tried to help their child's asthma without using medicine, with no difference between groups. Most (80.3%) viewed primary asthma care (ie, seeing the

TABLE 4. Selected Child Asthma-Management Practices Among Caregivers High and Low in Depressive Symptoms

	N	ρ	Depressive Symptoms		OR (95% CI)	P Value
			High	Low		
Frequently has problems using inhaler correctly	142	.153†	11 (16.9%)	3 (3.9%)	5.0 (1.3–18.9)	.009
Frequently forgets medications	143	.172*	15 (22.7%)	5 (6.5%)	4.2 (1.4–12.4)	.005
Forgot ≥ 2 days in past 2 weeks	143	.157†	23 (34.8%)	13 (16.9%)	2.6 (1.2–5.8)	.014

CI indicates confidence interval.

* $P < .05$.

† $P < .07$.

TABLE 5. Caregiver Beliefs Toward Selected Asthma-Management Practices

	<i>N</i>	ρ	Depressive Symptoms		OR (95% CI)	<i>P</i> Value
			High	Low		
Doctor does not explain what medicine is for and how to use it*	156	.158‡	12 (16.2%)	2 (2.4%)	7.7 (1.7–35.9)	.003
Tries to help asthma without using medicine*	158	.251§	17 (22.7%)	15 (18.1%)	1.3 (0.6–2.9)	.611
Worries about side effects*	157	.178§	33 (44.6%)	27 (32.5%)	1.7 (0.9–3.2)	.120
Feels unable to stop an asthma attack at home*	155	.202§	20 (27.4%)	9 (11.0%)	3.1 (1.3–7.3)	.009
Asthma primary care is important†	157	.128	59 (79.7%)	67 (80.7%)	0.9 (0.4–2.1)	.876

CI indicates confidence interval.

* All or most of the time.

† Extremely or very important versus somewhat or not at all important.

‡ $P < .05$.

§ $P < .01$.

doctor regularly even when the child was not having asthma symptoms) as being very important.

Satisfaction With Medical Care

Depressed mothers also reported significantly less satisfaction with medical care in general (see Table 6). Mothers with high levels of depressive symptoms were more likely to report that their beliefs did not agree with the recommendations of their child's doctor. Similarly, they also were more likely to believe that doctors sometimes miss important information provided by the patient and that health care providers are not concerned with the emotional needs of their patients. However, when directly asked about satisfaction with medical care, depressive-symptom status was not related to satisfaction

with their child's medical care; >90% indicated that they were satisfied with their child's current treatment, although more than half thought it could be better.

Medication Adherence, Long-Term Asthma Control, and Health Care Utilization

Medication adherence at baseline was moderately correlated with adherence 6 month later (Spearman's $\rho = .50$; $P < .001$). Similarly, frequency of asthma symptoms at baseline was modestly associated with symptoms 6 months later (Spearman's $\rho = .44$; $P < .001$). Days of missed medication in the previous 2 weeks at baseline were positively correlated with asthma symptoms reported 6 months later (Spearman's $\rho = .19$; $P = .02$).

TABLE 6. Attitudes Toward Care

	<i>N</i>	Depressive Symptoms		<i>P</i>
		High	Low	
Doctors let their patients tell them everything the patient thinks is important	158			.393
Agree		78.7%	86.7%	
Not sure		10.7%	6.0%	
Disagree		10.7%	7.2%	
I'm satisfied with the medical care my child receives	158			.326
Agree		90.7%	96.4%	
Not sure		4.0%	1.2%	
Disagree		5.3%	2.4%	
Some of my beliefs do not agree with what the doctor has said to do to treat asthma	158			.026
Agree		34.7%	27.7%	
Not sure		17.3%	6.0%	
Disagree		48.0%	66.3%	
Doctors always treat patients with respect	158			.110
Agree		80.0%	91.6%	
Not sure		9.3%	3.6%	
Disagree		10.7%	4.8%	
The medical care my child receives could be better	158			.642
Agree		38.7%	41.0%	
Not sure		17.3%	12.0%	
Disagree		44.0%	47.0%	
Doctors don't care if their patients worry	158			.024
Agree		18.7%	8.4%	
Not sure		18.7%	9.6%	
Disagree		62.7%	81.9%	
Sometimes doctors miss important information patients give	158			.012
Agree		48.0%	28.9%	
Not sure		18.7%	14.5%	
Disagree		33.3%	56.6%	
Total Score		4.3 \pm 3.0	2.9 \pm 2.4	.002

TABLE 7. Independent Predictors of Asthma Morbidity and Number of ED Visits at 6 Months in Inner-City Children With Asthma (N = 155)

	Regression Coefficient	95% CI	β	P Value
Asthma morbidity*				
Constant	.6397	−3.148 to 15.941		.187
Child asthma morbidity†	.341	.189 to .493	.342	<.001
Maternal CES-D score†	.368	.098 to .637	.208	.008
Frequently forgets medicine‡	−2.525	−4.500 to −.550	−.195	.013
ED visits§				
Constant	−.151	−.747 to .446		
Child asthma morbidity†	.024	.009 to .040	.234	.003
Maternal CES-D score†	.032	.005 to .058	.182	.019

CI indicates confidence intervals.

* Adjusted model $R^2 = .220$ with $df = 3, 132$; $P < .001$.

† Baseline values.

‡ Reported at follow-up.

§ Adjusted model $R^2 = .096$ with $df = 2, 155$; $P < .001$.

Linear regression was used to evaluate the independent contribution of select baseline variables including child age, family income, asthma morbidity, and maternal depressive symptoms and medication adherence at follow-up (see Table 7). Only medication adherence at baseline was associated with adherence at follow-up ($r = .183$; $P < .05$). Asthma morbidity, maternal depressive symptoms, and frequently forgetting medication (at follow-up) were associated with asthma morbidity at follow-up (adjusted $r^2 = .220$ with 3, 132, degrees of freedom [df]; $P < .001$). Baseline asthma morbidity and maternal depressive symptoms were independently associated with ED use 6 months later (adjusted $r^2 = .096$ with 2, 155 df; $P < .001$), but follow-up adherence did not contribute significantly to the model.

DISCUSSION

In this study, depression in inner-city mothers of young children with asthma was not associated with markers of the child's illness morbidity. However, maternal depression was associated with maternal reports of increased nonadherence to asthma therapy. As compared with mothers with low levels of depressive symptoms, depressed mothers reported that their children usually had trouble using their inhalers properly and frequently forgot to take their asthma medication. In the National Cooperative Inner-City Asthma Study involving children aged 4–9, Bauman et al³³ also noted that at baseline, poorer mental health in caregivers was associated with a greater tendency to report nonadherence to 9 potential physician recommendations for their child's asthma management. At follow-up 6 months later, maternal depression and poorer adherence were independently associated with more frequent asthma symptoms, after controlling for baseline asthma morbidity.

High levels of depressive symptoms in mothers were also associated with a greater impact of the child's illness on the mother, more negative maternal attitudes toward selected management practices, and communication difficulties with the child's doctor. Depressed mothers reported less confidence in the safety and effectiveness of their child's asthma medicine. A particularly worrisome finding was that de-

pressed mothers were nearly 8 times more likely to report that their child's doctor had not adequately explained the rationale for, or proper use of, asthma medicines. Overall, depressed mothers reported less satisfaction with their child's asthma therapy, asthma care, and health care providers in general. Beyond their doubts about the efficacy of asthma therapy, mothers with high levels of depressive symptoms also reported less confidence in their own ability to manage their child's acute asthma episodes at home. Thus, maternal depression seems to be associated with a constellation of beliefs and attitudes regarding their child's asthma management including less confidence in asthma therapy, physician visits, and the doctor's ability to help the family better control asthma symptoms and reduced parental self-efficacy to cope with acute asthma episodes.

The relationship between depression and poor treatment outcomes in adults has been well established. In older patients hospitalized with medical illnesses, depressive symptoms are independently associated with poorer outcomes⁶ and higher mortality rates, even after controlling for comorbid illness, as well as functional and cognitive impairments.⁹ Even subclinical levels of depression independently predict morbidity and mortality in cardiac patients.^{34,35} Depression also has been shown to have a substantial and significant negative impact on adherence with medical recommendations.¹⁷

Our results suggest potential mechanisms by which depression in mothers may lead to poor pediatric asthma outcomes. First, high depressive symptoms (suggestive of depression) in mothers were associated with decreased child adherence with asthma therapy. This seems understandable given that depressed mothers reported significantly less confidence in and understanding of the methods and goals of asthma therapy and less satisfaction overall with their child's asthma care. Adherence to recommended therapy for asthma is based, at least in part, on the patient's (or parent's) belief that the recommended therapeutic actions have a good probability of leading to positive outcomes (ie, better asthma control). Conversely, reduced optimism in the efficacy and benefits of asthma therapy would likely lead to declining adherence. Suboptimal symp-

tom management, in turn, may reinforce lowered expectations for asthma control and reinforce beliefs about the futility of asthma therapy. Thus, the finding that medication adherence is poorer in children of depressed mothers is not surprising.

Beyond medication adherence, other behaviors, thoughts, and feelings associated with high levels of depressive symptoms in mothers may also create and perpetuate asthma-management difficulties. For example, characteristics of depression include the tendency to become socially isolated and to withdraw from interactions with others, memory impairments, and feelings of hopelessness, helplessness, and futility.³⁶ Our results suggest that critical factors associated with a mother's ability to care for her ill child, including medication adherence, communication with the child's physician, overall satisfaction with child's asthma management, and parent self-efficacy to manage exacerbations, may be compromised significantly when the mother is experiencing high levels of depressive symptoms.

As anticipated, increased nonadherence to ICS was associated with a greater frequency of asthma symptoms over the following 6 months. We have shown previously that mothers with high levels of depressive symptoms were more likely to take their child to the ED (and be frequent users of the ED).¹⁹ Contrary to our expectations, we did not find a direct relationship between ICS adherence and subsequent ED use. However, pediatric ED use is multifactorial. Predictors of urgent care use include factors related to the child (ie, age),^{19,37,38} asthma symptoms (ie, frequency),^{19,37,38} medications (number prescribed),^{37,38} and asthma management (ie, previous hospitalizations for asthma or unclear criteria for deciding when to seek emergency care).^{37,38} The mother's emotional well being,¹⁹ perception of her child's needs,³⁹ and level of social support³⁷ have also been shown to be independently associated with the decision to seek medical care. In addition, because maternal self-reports of medication nonadherence in this study were relatively rare, statistical power may have been inadequate to detect differences between groups. Additional studies are needed to assess whether health care utilization is influenced by medication nonadherence in depressed mothers.

As has been reported, depression is pervasive among inner-city mothers.^{19,20} In our sample, depressive symptoms were not correlated with markers of asthma morbidity, suggesting that there is no direct relationship between the actual burden of the child's illness and the mother's emotional well being. Perhaps mothers who are more psychologically vulnerable may develop depression in response to the continued stress of having a chronically ill child. Once depressed, a downward spiral may develop in which mothers are less able to manage their child's illness effectively, asthma symptoms persist and increase, satisfaction with medical care decreases, and expectations of the effectiveness of asthma therapy fall, ultimately resulting in treatment nonadherence and increased health care use. Conversely, mothers with depression may be less able to cope with a range of life stressors including a child's illness.⁴⁰

Effective treatments for depression exist⁴¹ that offer promise to enhance maternal functioning and quality of life for parent and child.^{42–44} In addition, successful interventions to improve medication adherence,^{45,46} enhance patient-physician communication,^{47,48} and increase parental self-confidence^{49–51} are available. Social support seems to buffer the impact of stressful life events in mothers with ill children.⁴⁰ The question of whether treatment of maternal depression would enhance child adherence to asthma therapy has not been empirically addressed. However, preliminary evidence in persons with multiple sclerosis suggests that treatment of depression, by either cognitive-behavioral therapy or antidepressants, enhances adherence to pharmacotherapy.^{52,53} Hence, if depression in mothers of children with asthma is recognized and addressed, at a minimum, this will enhance quality of life and parental functioning. Treatment of maternal depression may also offer an important opportunity to optimize medication adherence, asthma management, and appropriate health care use in the inner city.

There are several limitations to this study. As with all self-report data, reporting bias may exist, and there is a tendency for correlation among self-report variables. In studies, most individuals underreport medication nonadherence,⁵⁴ and rates of reported medication nonadherence in this study were notably lower than those obtained in other asthma studies when electronic medication monitoring has been used.^{51,55,56} We were also unable to determine whether medication adherence truly was lower in children of depressed mothers or whether depressed mothers were simply more candid about their child medication use, because self-reports of treatment nonadherence have been shown to be highly reliable and valid.⁵⁴ Concern about reporting bias by depressive-symptom status is reduced somewhat by the fact that no differences by depressive-symptom status were evident in several asthma-related variables including the frequency of asthma symptoms, use of asthma medications or home remedies, or concerns about medication side effects. The use of medication-monitoring devices would provide objective information about the relationship between maternal depression and child treatment adherence. A depression screening test, the CES-D, was used with a predetermined cutoff point to classify individuals as being at risk for depression (ie, high CES-D scores). Although this is a common strategy in population and clinical research,^{13,57} it is important to note that CES-D scores cannot be used to "diagnose" individuals. Clinical interviews would have allowed us to classify individuals more accurately. Finally, underlying asthma severity was inferred by evaluating the mother's reports of symptom frequency during the previous 6 months.

CONCLUSIONS

Asthma morbidity and mortality is high among inner-city children. Effective partnerships between providers and families of children with asthma as well as adherence to treatment are essential to optimal illness diagnoses, management, and outcomes.

Maternal depression, although widespread, is a treatable condition and has been shown to predict ED use in this population. For these reasons, evaluation of the mother's emotional status may be important when considering a child's asthma treatment. At a minimum, health care providers need to ensure that communication is well established with the child's mother and that treatment goals and methods are agreeable to all. Depressed mothers may also benefit from discussions that focus on strategies to assign medication-related roles appropriately between parent and child and to monitor medication adherence.

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